

Certification Test Plan – Modification

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Prepared for:

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**Accredited by the Election
Assistance Commission (EAC) for
Selected Voting System Test
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1 INTRODUCTION

This Modification Certification Test Plan outlines the test approach SLI Compliance will follow when performing Certification Testing on the **Hart Verity Voting 2.2 voting system** against the 2005 Voluntary Voting System Guidelines (VVSG). **Verity Voting 2.2** is a modification of **Verity Voting 2.0**, with limited changes. The system will be tested based on the “modified system” requirements, as set forth in section 4.6.2.3 of the “**EAC Voting System Testing and Certification Program Manual, version 2.0**”.

When the testing is complete, SLI will submit a Certification Test Report that details all test results and findings from the Certification Test effort, as well as a recommendation to the **EAC**.

1.1 Description and Overview of the Certified System

This test plan contains a description of the previously certified system, the specific modifications to the current system version, and the impact of those modifications on the system and certification testing.

1.1.1 Definition of the Baseline Certified System

This modification project builds upon the foundation established in **Verity Voting 2.0**, which contained the applications **Verify Data**, **Verify Build**, **Verity Central** and **Verity Count**, as well as the polling place devices **Verity Scan** and **Verity Touch Writer**, **Verity Controller**, **Verity Touch**, **Verity Touch with Access** and **Verity Print**.

1.1.2 Modifications

Verity Voting 2.2 is a modification of the EAC-certified Verity Voting 2.0 system.

Verity Voting 2.2 includes the following new modifications:

1. **Verity Scan** – capability to clear **vDrives** and device counters
2. **Verity Scan** – support for re-opening of polls after they have been closed
3. **Verity Relay** – accessory option for **Verity Scan**, with **Verity Relay** host (receiving station) software – remote transmission of results
4. **Verity Count** – support for update of previously-read **vDrive** results

Note that **Verity Voting 2.2** is also modified such that **Verity Controller**, **Verity Touch**, and **Verity Touch with Access**, have been removed from this version of the **Verity** voting system.



1.1.3 Initial Assessment of Impact of the Modifications

Verity Scan's modification to provide the capability to clear a **vDrive** and device counters is an isolated update that affects only the **Verity Scan** device. After executing a Logic and Accuracy Test, the jurisdiction will have the capability to erase the contents on the **Verity vDrive** without having to remove it from the device. Rather, they will be able to clear the **Verity vDrive** and reuse it for the official election.

Verity Scan's modification to provide the capability to re-open polls after they have been closed has impact on both the **Verity Scan** device and **Verity Count**, which is discussed below. This modification allows for jurisdictions that have a need to scan additional ballots after the initial closure of polls. If additional ballots must be scanned, poll workers will now have the option to re-open the polls and scan additional ballots.

Verity Relay provides a remote transmission capability to the **Verity Voting 2.2** system. Utilizing an optional cellular modem on **Verity Scan**, at close of polls, results are transmitted from the polling place device to the **Verity Relay** station. These results are moved to a **Verity vDrive** and transferred to **Verity Count**. With the new ability to re-open polls, the **Verity Relay** will potentially have multiple iterations of results sent by the same device. **Verity Relay** will be verified to handle this in an appropriate manner.

With the new ability to re-open polls, **Verity Count** will potentially have multiple iterations of results sent by the same device. **Verity Count** may have results uploaded, from both **Verity Relay vDrives**, as well as from any polling place device **vDrive**. **Verity Count** has been modified for this instance and will be verified to handle this in an appropriate manner.

Review of the modifications implemented and source code modified indicates the need for only a limited Functional Configuration Audit in order to verify that the system continues to meet 2005 VVSG 1.0 requirements. The limited FCA takes into account not only the implemented modifications, but also functions that have not changed but may be impacted by a modification.

Software/firmware that either has modified source code or requires a new build will be subjected to FCA review at an appropriate level of scrutiny.

Verity Scan and **Verity Count** have modified source code and will require new builds. **Verity Relay** source code is new to the system and will require a build. **Verity Data** and **Verity Build**, while not having any modified source code, will require new builds for version control purposes in the new system configuration.



1.1.4 Regression Testing

This section describes what system elements will be regression tested to establish assurance that the modifications have no adverse impact on the compliance, integrity or performance of the system.

All elements of **Verity Voting 2.2** will be regression tested in order to verify continued compliance to (2005) VVSG 1.0.

Each modification will be explicitly tested and verified in **Verity Scan** and **Verity Count**. **Verity Relay** will be tested as outlined within this document. Additionally, Security checks pertinent to changes on **Verity Scan**, and **Verity Relay** as a new application, will be conducted, as well as Audit, Error Messaging/Recovery, Maintainability, Data Retention and Hardware Integrity verifications. Additionally, one system level general election and one system level closed primary election test will be performed to verify system robustness.

1.2 References

The following key documents were used in preparing this test plan.

1. Election Assistance Commission Voluntary Voting System Guidelines (EAC VVSG), 2005 Version 1.0 Volumes I and II.
2. NIST Handbook 150: 2016.
3. NIST Handbook 150-22: 2008.
4. EAC Voting System Testing and Certification Program Manual, United States Election Assistance Commission, v 2.0, May 2015
5. SLI VSTL Quality System Manual, Rev. 2.1, prepared by SLI, dated Aug. 1st, 2016.

1.3 Terms and Abbreviations

The following terms and abbreviations will be used throughout this document:

Table 1 – Terms and Abbreviations

Term	Abbreviation	Description
Ballot Marking Device	BMD	An accessible computer-based voting system that produces a marked ballot (usually paper) that is the result of voter interaction with visual or audio prompts.
Central Count Scanner	CCS	High Speed Optical Scanner is a mark sense-based ballot and vote counting device typically located at a central count facility and is operated by an automated multi-sheet feeding capability.



Term	Abbreviation	Description
Compact Flash card	CF	This is a type of flash memory card in a standardized enclosure often used in voting systems to store ballot and/or vote results data.
Compact Flash AST	CFAST	A compact flash media based on the Serial ATA bus rather than the Parallel ATA bus, used by the original CompactFlash.
Chevron	No Abbreviation	Verity components use workflow chevrons. Workflow chevrons, arranged along the top of the screen, identify the function the user is currently viewing.
Commercial Off the Shelf	COTS	Term used to designate computer software, hardware or accessories that are ready-made and available for sale, lease, or license to the general public.
Direct Recording Electronic	DRE	Voting systems that, using Touch Screen or other user interfaces, directly record the voter's selections in each race or contest on the ballot in electronic form.
Election Assistance Commission	EAC	An independent, bipartisan commission created by the Help America Vote Act (HAVA) of 2002 that operates the federal government's voting system certification program.
Election Management System	EMS	Typically a database management system used to enter jurisdiction information (district, precincts, languages, etc.) as well as election specific information (races, candidates, voter groups (parties), etc.). In addition, the EMS is also used to layout the ballots, download the election data to the voting devices, upload the results and produce the final results reports.
Electromagnetic Compatibility	EMC	The goal of EMC is to validate the correct functioning of different equipment in the same environment and the avoidance of any interference effects between them.
Functional Configuration Audit	FCA	The testing activities associated with the functional testing of the system.
National Institute of Standards and Technology	NIST	A non-regulatory federal agency within the U.S. Dept. of Commerce. Its mission is to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve our quality of life.



Term	Abbreviation	Description
National Voluntary Laboratory Accreditation Program	NVLAP	A division of NIST that provides third-party accreditation to testing and calibration laboratories.
Physical Configuration Audit	PCA	The testing activities associated with the physical aspects of the system (hardware, documentation, builds, source code, etc.).
Precinct Count Scanner	PCS	A precinct-count optical scanner is a mark sense-based ballot and vote counting device located at a precinct and is typically operated by scanning one ballot at a time.
Request For Information	RFI	A means used by testing laboratories and manufacturers to request that the EAC provide an interpretation of a technical issue related to testing of voting systems.
Requirements Matrix	N/A	A matrix that traces the VVSG requirements to the various test modules and test methods.
Standard Lab Procedure	SLP	SLI's quality system documentation is made up of standard lab procedures (SLPs), which are procedures required to ensure a systematic, repeatable and accurate approach to voting systems testing and governing the actual performance of SLI's work.
Technical Data Package	TDP	The data package supplied by the vendor, which includes Functional Requirements, Specifications, End-user documentation, Procedures, System Overview, Configuration Management Plan, Quality Assurance Program, and manuals for each of the required hardware, software, firmware components of a voting system.
Test Method	TM	SLI proprietary documents which are designed to group sets of EAC VVSG requirements in a logical manner that can be utilized to more efficiently validate where and how requirements, or portions of a requirement, are met.
Validation	No Abbreviation	Confirmation by examination and through provision of objective evidence that the requirements for a specific intended use or application have been fulfilled (ISO 9000).
Verification -	No Abbreviation	Confirmation by examination and through provision of objective evidence that specified requirements have been fulfilled (ISO 9000).



Term	Abbreviation	Description
Voluntary Voting System Guidelines	VVSG	A set of specifications and requirements against which voting systems can be tested to determine if the systems provide all of the basic functionality, accessibility and security capabilities required for EAC certification.
Voter Verifiable Paper Audit Trail	VVPAT	An independent verification system for voting machines designed to allow voters to verify that their vote was cast correctly, to detect possible election fraud or malfunction, and to provide a means to audit the stored electronic results.
Voting System Test Lab	VSTL	An independent testing organization accredited by NVLAP and the EAC to conduct voting system testing for EAC certification.
Voting System Under Test	VSUT	The designation for a voting system that is currently being tested.
Voting Test Specialist	VTS	An SLI employee within the Compliance division who has been qualified to perform EAC voting system certification testing.

1.4 Testing Responsibilities

The following project schedule contains owner assignments and identifies test procedure (module) development and validation, test case (suite) development, 3rd party tests, as well as EAC and Manufacturer dependencies.

1.4.1 Project Schedule

The subsections below describe the project schedule.

1.4.1.1 Owner Assignments

- System Analysis and Review will be conducted by Source Code Review, Security and Voting Test Specialists, with oversight by the Test Manager
- Source code review will be conducted by Source Code Review Specialists, with oversight by the Test Manager
- Documentation review will be conducted by Security and Voting Test Specialists, with oversight by the Test Manager
- Test Module Development and Validation will be conducted by Security and Voting Test Specialists, with oversight by the Test Manager
- Test Suite Development and Validation will be conducted by Security and Voting Test Specialists, utilizing SLI's formal Test Methods, with oversight by the Test Manager



- Formal Test Execution will be conducted by Security and Voting Test Specialists, with oversight by the Test Manager

1.4.1.2 Test Module Development and Validation

Test Modules will be developed to provide repeatable detailed test steps. The Modules are defined at a basic level in SLI's formal Test Methods and are designed for use in any suite that employs their functionality. This reusability reduces the development time associated with creating Modules. The Modules will be validated prior to Formal Test Execution to ensure accurate testing of the voting system. Additionally, the Test Modules will provide traceability to SLI's formal Test Methods, as well as the 2005 VVSG 1.0 requirements. This is done by listing the Test Method name, and each requirement addressed, in the name of the module.

1.4.1.3 Test Suite Development

Test Suites will be developed to help group and focus testing around key areas of the voting system. The Test Suites will contain multiple test modules providing clear and traceable test scripts and information.

1.4.1.4 Trusted Build

Prior to Formal Test Execution, a Trusted Build will be performed for **Verity Scan** and **Verity Count** in order to include modifications made to those applications. Although **Verity Data** and **Verity Build** have unmodified source code, they will be rebuilt for version control. **Verity Relay** will also be built within the Trusted Build process, after its source code has undergone source code review.

1.4.1.5 Formal Test Execution

Formal execution of the validated Test Suites and modules will be conducted to verify the system's compliance with the 2005 VVSG 1.0 requirements.

1.4.1.6 Third Party Hardware Testing

Hardware testing will be conducted by third party, certified hardware test laboratories to verify the voting system hardware devices comply with the VVSG hardware requirements. Under the 2005 VVSG 1.0, this portion of the certification is considered to be part of the FCA.



Other Labs Performing Hardware Testing

SLI Compliance is responsible for all core voting system tests as identified in NIST NVLAP Handbook 150-22 (2008). The labs listed below will perform non-core hardware testing for this certification test campaign.

Table 2 – Labs Performing Hardware Testing

Laboratory	Address	Test(s)	Date(s)
NTS, Inc. (NVLAP certified for electromagnetic compatibility and telecommunications)	1736 Vista View Drive Longmont, CO 80504	EMC / EMI Tests: ESD Electromagnetic Susceptibility	October 4 th , 2016

1.4.1.7 Project Timeline

The following schedule outlines the expected timeline for this project.

Task Name	Start	Finish
Hart Verity 2.2 Federal Certification Project Plan	Wed 9/7/16	Thu 10/27/16
Phase 1	Wed 9/7/16	Tue 10/18/16
Project Initiation	Wed 9/7/16	Wed 9/7/16
TDP Deliver/Receive Vendor Package	Wed 9/7/16	Wed 9/7/16
TDP Review	Wed 9/7/16	Wed 9/21/16
FCA Assessment	Wed 9/7/16	Fri 9/16/16
Hardware	Wed 9/7/16	Fri 9/30/16
HW / SW Configuration Audit	Wed 9/7/16	Fri 9/9/16
Develop HW TestPlan	Fri 9/9/16	Mon 9/12/16
Hardware Test Execution	Tue 9/27/16	Fri 9/30/16
Test Plan Development	Wed 9/7/16	Tue 10/18/16
Phase 2	Thu 9/8/16	Thu 9/8/16
Training	Thu 9/8/16	Thu 9/8/16
Readiness Test	Thu 9/8/16	Thu 9/8/16
Phase 3	Thu 9/8/16	Wed 9/14/16
Vendor Specific Module and Suite Creation/Updates	Thu 9/8/16	Wed 9/14/16
Phase 4	Mon 9/12/16	Tue 10/4/16
Test Suite Validation	Mon 9/12/16	Mon 10/3/16
Validate Test Suites	Mon 9/12/16	Mon 9/19/16
Discrepancy Report	Mon 9/19/16	Mon 9/19/16
Send Validated Test Suites to EAC	Thu 9/29/16	Mon 10/3/16
Trusted Build	Tue 9/27/16	Tue 10/4/16
Phase 5	Fri 9/30/16	Tue 10/11/16
Official Test Execution of Test Suites	Fri 9/30/16	Tue 10/11/16
Prep Test Environment	Fri 9/30/16	Mon 10/3/16
Execute Test Suites	Mon 10/3/16	Mon 10/10/16
Final Documentation Updates	Mon 10/10/16	Tue 10/11/16
Phase 6	Wed 9/7/16	Wed 10/26/16
Certification Test Report and Final Test Plan	Mon 10/10/16	Wed 10/26/16
Project Management	Wed 9/7/16	Tue 10/18/16
Phase 7	Wed 10/26/16	Thu 10/27/16
Return Equipment to Hart	Wed 10/26/16	Thu 10/27/16
Archive Test Materials	Wed 10/26/16	Thu 10/27/16



1.4.1.8 EAC & Manufacturer Dependencies

The Test Plan will require **EAC** approval prior to finalization.

Hart InterCivic will be required to provide all source code, documentation, equipment and supporting materials identified as part of the voting system.

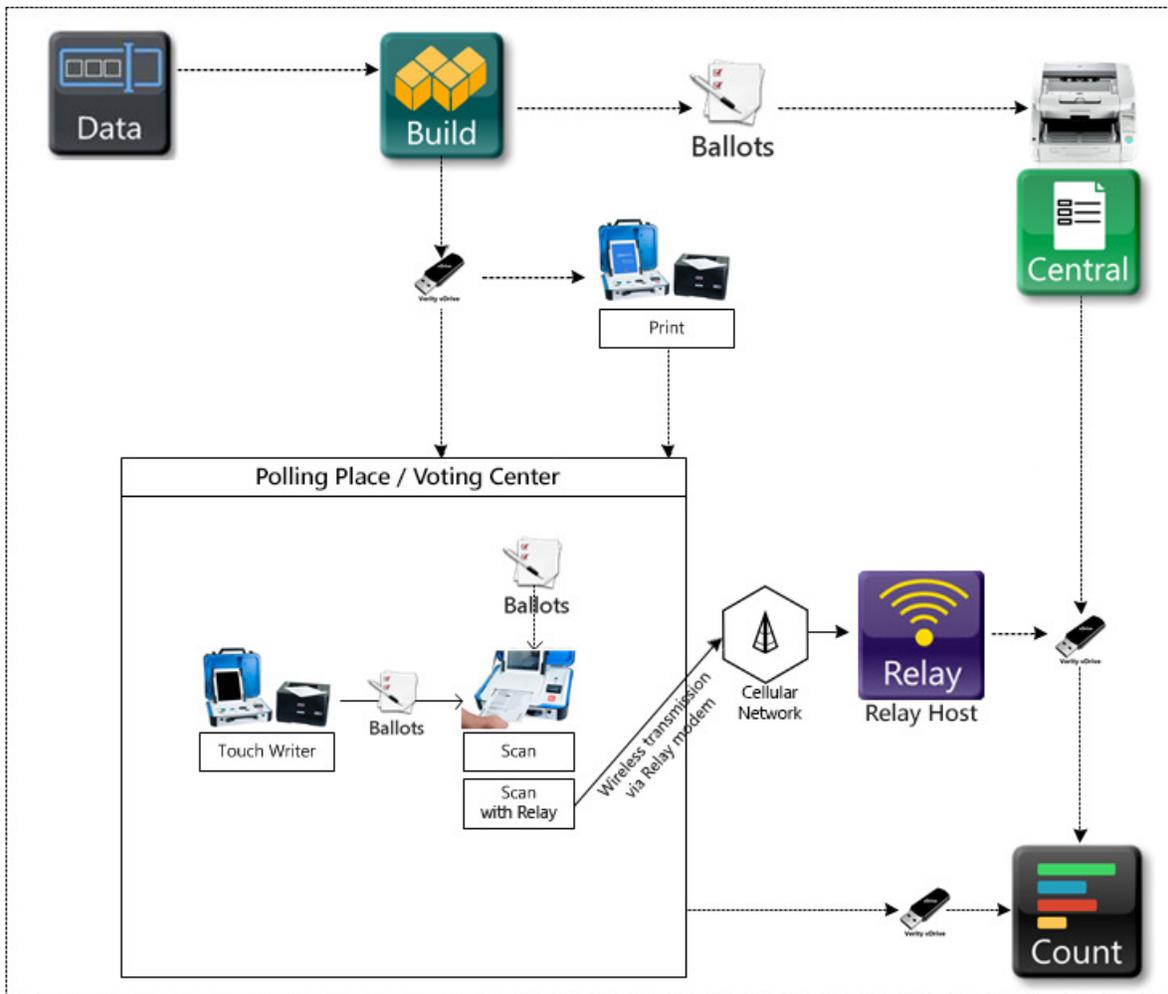
The source code must have all discrepancies resolved, be able to be built successfully, installed, as well as successfully complete Readiness Testing prior to Formal Test Execution.

In addition, **Hart InterCivic** is required to provide training on the voting system and support throughout the life of the project.

Please see the Project Plan, in section 1.4.1.7, for a detailed listing of all activities within the scope of this test campaign.

1.5 Scope of Testing

1.5.1 Block Diagram



Overview of the diagram:

- The components are displayed as touch points of data access, transfers, and verification.
- Dotted lines show the flow of data and air gaps using **vDrives**.
- **Verity Print** is a ballot production device that provides unmarked printed ballots.
- **Verity Touch Writer** and **Verity Scan** (Verity Voting devices) may be installed in Polling Places.
- **Verity Key** (not shown) is required for user access into components to load election elections, use features, and generate reports. Feature access depends on the roles applied to user accounts.
- **Verity Relay** is a transmission option within the Verity Voting system.



1.5.2 EAC Request For Interpretation – RFI

The test engagement described in this Certification Test Plan utilizes only standard VSTL test methods that conform to the **EAC** Testing and Certification Program Manual and the identified voting system standard. Additionally, all test methods employed are updated to account for all **EAC** RFI's.

This Certification Test Plan and the execution of tests for the voting system identified in this plan include application of the following **EAC** RFI's:

- RFI 2012-05 -- EAC Decision on Public Telecommunications and Cryptography
- RFI 2012-06 -- EAC Decision on Use of Public Telecommunications Networks and Data Transmission

1.5.3 EAC Notices of Clarification - NOC

This Certification Test Plan and the execution of tests for the voting system identified in this plan includes the following NOC's:

- NOC 13-02: Detailed Description of Changes for Modifications
- NOC 09-005: Development and Submission of Test Plans for Modifications to EAC Certified Systems.
- NOC 09-002: Clarification of EAC Laboratory Independence Requirement
- NOC 09-001: Clarification of the Requirements for Voting System Test Laboratories (VSTLs) Development and Submission of Test Plans
- NOC 08-003: Clarification of EAC Conformance Testing Requirements for Voting System Test Laboratories (VSTLs)
- NOC 07-005: Voting System Test Laboratory (VSTL) responsibilities in the management and oversight of third party testing.



2 PRE-CERTIFICATION TESTING AND ISSUES

2.1 Evaluation of prior VSTL testing

Prior VSTL testing has been performed on the **Hart Verity Voting 2.2** voting system. A full test campaign was done by SLI during the **Verity Voting 2.0** EAC certification project, on the main code base that constitutes **Verity Voting 2.2**. Additionally, **Verity Scan with Relay** and the **Verity Relay** host application were reviewed by SLI as part of a State of Michigan campaign in early 2016.

2.2 Evaluation of prior non-VSTL testing

No prior state or non-VSTL lab testing has been performed on the **Hart Verity Voting 2.2** voting system. Review of Hart internal testing is performed during the FCA review.

2.3 Known Field Issues

Hart Verity Voting 2.2 is a modification of **Verity Voting 2.0**, which has had only limited exposure in the field.

Within the declared system, the only voting devices are the **Verity Scan** precinct optical scanner, which processes ballots marked by voters, **Verity Touch Writer**, a ballot marking device, **Verity Print** is a pre-voting ballot production device that is used to print blank ballots. These devices are included as part of the **Verity Voting 2.2** voting system.

Verity Central is a central count location device, which is implemented in a secure environment.

There are no known field issues or vulnerabilities to this particular system at this time.

Review of the “Known Vulnerabilities” database, maintained by SLI, has provided 14 known vulnerabilities to previous Hart systems (Hart InterCivic eSlate System Version 6.21) already accounted for in SLI’s Test Methods.



3 MATERIALS REQUIRED FOR TESTING

Any materials that are used in an election cycle must be provided to SLI to facilitate testing of the voting system. This section outlines these required materials.

3.1 Software/Firmware

All software and firmware that is to be used by the declared voting system, whether directly or indirectly, in a production environment, must be validated during the certification process.

The following software/firmware is required for the execution of hardware, software, telecommunications, and security tests. This includes all supporting software such as operating systems, compilers, assemblers, application software and firmware, any applications used for burning of media, transmission of data or creation/management of databases.

3.1.1 Hart Verity Voting 2.2 Software/Firmware

Hart Verity Voting 2.2 voting system consists of the following software and firmware components:

- **Verity Data** EMS software
- **Verity Build** EMS software
- **Verity Central** high speed optical scanner software
- **Verity Count** central count location tabulation and reporting software
- **Verity Scan** optical scanner firmware
- **Verity Touch Writer** BMD firmware
- **Verity Print** printer firmware
- **Verity** Device Microcontroller firmware for **Verity Touch Writer**
- **Verity Relay** software.

Note: Versions for each will be available after execution of the Trusted Build, and will be listed in the Test Report.



3.1.2 COTS Software/Firmware

This section details the Commercial Off The Shelf software and firmware utilized within the **Verity Voting 2.2** system.

Table 2 – COTS Software/Firmware

Manufacturer	Application	Version	Verity Voting 2.2 Component
Microsoft	Microsoft Windows Embedded Standard 7 with Service Pack 1 – 64bit	6.1.7601	Data/Build, Data/Build + Count, Central, Count, Print, Scan, Touch Writer
Microsoft	Microsoft SQL Server 2012 for Embedded Systems	11.00.2100	Data/Build, Data/Build + Count, Central, Count
Microsoft	Microsoft SQL Server 2012 Express	11.00.2100	Print, Scan, Touch Writer
McAfee	McAfee Application Control for Devices	6.1.1.369	Data/Build, Data/Build + Count, Central, Count, Print, Scan, Touch Writer
Microsoft	Windows Communication Foundation (WCF)	4.5	Relay host, Scan with Relay

3.1.3 Additional Supporting Test Software

This section outlines all test specific software that will be used in the certification campaign.

Table 3 – Additional Supporting Test Software

Manufacturer	Application
Riverbed	WireShark
LocMetrics	<u>LocMetrics Line Counter</u> , a commercial application used to determine the counts of executable and comment lines
SLI	<u>Module Finder</u> , a SLI proprietary application used to parse module names from C/C++, Java and VB code and populate the identified module names into the review documents
PrestoSoft	<u>ExamDiff Pro</u> : a commercial application used to compare revised code to previously reviewed code



3.2 Equipment

The following equipment is required for the execution of the hardware, software and security tests. This includes system hardware, general purpose data processing and communications equipment, and any test instrumentation required.

3.2.1 Hart Verity Voting 2.2 Equipment

The following **Hart Verity Voting 2.2** equipment will be used in testing:

Table 4 – Hart Verity Voting 2.2 Equipment

Hardware	Model
Verity Scan (digital scanner)	Revision C
Verity Scan optional cellular modem	Revision A
Verity Touch Writer (BMD)	Revision C
Verity Print	Revision B

3.2.2 COTS Equipment

The following Commercial Off-the-Shelf equipment will be used in testing:

- Desktops/Laptops
- Printers

Table 5 – COTS Equipment

Manufacturer	Hardware	Model
OKIDATA (for Verity Data, Verity Build, Verity Print, Verity Central, Verity Touch Writer and Verity Count)	Ballot and Report Printer	B431d
OKIDATA (for Verity Print, Verity Build)	Ballot Printer	C831dn
OKIDATA (for Verity Print, Verity Build)	Ballot Printer	C911dn
OKIDATA (for Verity Count)	Ballot Printer	ML-1121
Eaton	UPS for Verity Touch Writer printer	5P1500
Various (for Verity Data, Verity Build, Verity Central and Verity Count)	Intel-Windows Workstation (Minimum Requirements) Processor – Intel Celeron D 420	



Manufacturer	Hardware	Model
	3.06GHz Dual Core Memory – 2GB Hard Drive – 120 GB Removable Storage – 8xDVD+/-RW Slim line USB Ports – 4 ports Video Card - Integrated Graphics Keyboard - USB Keyboard Mouse - USB Mouse	
Various (for Verity Data , Verity Build , Verity Central and Verity Count)	Monitor (Minimum Requirements) Panel Size - 50.8 cm Aspect Ratio - Widescreen (16:9) Optimal Resolution - 1600 x 900 at 60Hz Contrast Ratio - 1000: 1 Brightness - 250 cd/m2 (typical)	
Kodak (for Verity Central)	Document Scanner	i5600
Canon (for Verity Central)	Ballot Scanner	DR-G1100
Canon (for Verity Central)	Ballot Scanner	DR-G1130
QuickCarrier® USB-D by MultiTech Systems cellular modem	Aeris cellular modem	MTD-EV3- N16
QuickCarrier® USB-D by MultiTech Systems cellular modem	Sprint cellular modem	MTD-EV3- N2
QuickCarrier® USB-D by MultiTech Systems cellular modem	Verizon cellular modem	MTD-EV3- N3
QuickCarrier® USB-D by MultiTech Systems cellular modem	Global (AT&T, T-Mobile, etc...) cellular modem	MTD-H5-2.0

3.3 Test Materials

The following test materials are required for the performance of testing including, as applicable, test ballot layout and generation materials, test ballot sheets, test ballot cards and control cards, standard and optional output data report formats, and any other materials used in testing.

- Ballots & Blank Ballot grade paper
- Thumb Drives
- Ballot marking pens
- Printer paper rolls



3.4 Deliverable Materials

The following are documents and materials to be delivered as a part of the **Hart Verity Voting 2.2** system.

- Change Notes Verity Voting, Version 2.0 to 2.2
- Technical Reference Supplement – Reading vDrives
- Technical Reference Supplement – Clearing vDrives and Re-Opening Polls
- Verity Relay – Technical Reference Manual
- Relay – Theory of Operations
- Specifications and Manuals
- Verity System Description
- Verity Voting System Limits
- Verity Airgap Interface Technical Reference Manual
- Verity Software Architecture Design
- System Description Technical Document
- Verity Central Technical Requirements Document
- Verity Count Technical Requirements Document
- Election Management Technical Requirements Document
- Electronic Voting Devices Technical Requirements Document
- Verity Key Design Technical Document
- Verity Logging Technical Requirements Document
- Verity Precinct Scanner Technical Requirements Document
- Verity Security Requirements Document
- Verity Datastore Schema
- System Description Technical Document
- Verity Security Requirements
- Verity Risk and Threat Assessment
- Verity Key Design
- Verity Service and Maintenance Guide
- Verity Software Architecture Design
- Verity Voting Maintenance Information Operations Guide
- Election Definition and Device Settings Technical Reference Manual
- Central Ballot Scanning and Review Software Technical Reference Manual
- Count Vote Tabulation Software Technical Reference Manual
- Verity Voting Maintenance Information
- Operations Guide
- Quality Manual
- Voting System Implementation and Maintenance
- Supplier Qualification and Management
- Verity Operational Guide
- Verity Performance Characteristics
- Verity Bill of Materials and Approved Vendor List for each Verity Component



- Verity Scan Assembly
- Verity Touch Writer Assembly
- Verity Access Assembly
- Verity Ballot Box Assembly
- Verity Standard Booth Assembly
- Verity Accessible Booth Assembly
- Verity Electronics Specification
- Verity Base Station Microcontroller Specification
- SQA Requirements Management Process
- Management and Best Practices Training Agenda
- Verity Data Training Agenda
- Verity Build Training Agenda
- Verity Central Training Agenda
- Verity Count Training Agenda
- Verity Service and Maintenance Training Agenda
- Verity Polling Place Operations Training Agenda
- Assisting Persons With Disabilities Training Agenda
- Train the Trainer Training Agenda
- Verity Operations PRD – Ops/Services/Supply Chain Planning Document
- Configuration Management Process
- Verity Operational Guide
- Software Versioning Procedure
- Voting System Implementation and Maintenance



4 TEST SPECIFICATIONS

The following are the specifications for testing to be conducted on the **Hart Verity Voting 2.2** system. The specifications contain details on the focus of testing, configuration(s), and the functions to be tested.

4.1 Requirements

4.1.1 VVSG Requirements

The **Verity Voting 2.2** modifications will be tested to 2005 VVSG 1.0 requirements.

Verity Scan's modification to provide the capability to clear a **vDrive** and device counters is an isolated update that affects only the **Verity Scan** device.

Pertinent VVSG requirements are:

- 2.1.1.a,b,c,f,g
- 2.1.4.h,i
- 2.1.8.a-d
- 2.2.4.d,f

Verity Scan's modification to provide the capability to re-open polls after they have been closed has impact on both the **Verity Scan** device and **Verity Count**.

Pertinent VVSG requirements are:

- 2.1.1.a,b,c,f,g
- 2.1.4.h,i
- 2.1.2.c
- 2.2.4.d
- 2.1.4.a,e
- 7.5.5

With the new ability to re-open polls, **Verity Count** will potentially have multiple iterations of results sent by the same device.

Pertinent VVSG requirements are:

- 2.1.2.c
- 2.2.4.d

Verity Relay provides a remote transmission capability to the **Verity Voting 2.2** system. Utilizing an optional modem on **Verity Scan**, at close of polls, results are transmitted from the polling place device to the **Verity Relay** station.



Pertinent VVSG requirements are:

- 2.1.1.a,b,c,f,g
- 2.1.4.h,i
- 2.1.9
- 2.2.4.d
- 4.1.2.15
- 6
- 7.5.1-3
- 7.6.1
- 7.6.2
- 7.7

As all Verity Voting applications, including Verity Relay, reside in a dedicated workstation “kiosk” environment that does not allow any non-voting applications or processes to run, section 7.5.4 is deemed not applicable to this test effort.

4.1.2 Hardware Requirements

Analysis of implementation of the Relay configuration of the added cellular modem to the **Verity Scan** device resulted in the SLI conclusion of the necessity to test the following requirements:

- 4.1.2.8
- 4.1.2.10

4.1.3 Hart State Specific Modification Requirements

The requirements in this section are provided in order to clearly specify the modifications implemented to satisfy state jurisdiction requests for additional functionality.

Two modifications are implemented, one allows **Verity Scan** to clear vDrives and device counters, under proper conditions. The second modification allows **Verity Scan** to re-open polls, with proper credentials.

The following requirements represent Hart internally developed specifications designed to satisfy these jurisdictional requests.

Verity Scan’s modification to provide the capability to clear a **vDrive** and device counters is an isolated update that affects only the **Verity Scan** device

Pertinent Hart requirements are:



- 4.1.3.1 [MUST] The vDrive used for the test must be the same vDrive used in the election.
- 4.1.3.2 [MUST] When the Verity Scan tabulator is in a “Polls Closed” state, it shall have the capability to “Clear ballots and counters.”
- 4.1.3.3 [MUST] When the Verity Scan tabulator is in “Polls Suspended” state, it shall have the capability to “Clear ballots and counters.”
- 4.1.3.4 [MUST] When the option to “Clear ballots and counters” is selected, the user shall be prompted to confirm “yes” to proceed, or “no” to cancel.
- 4.1.3.5 [MUST] If the user selects, “Yes, clear ballots and counters,” the user shall be prompted to insert the Verity Key.
- 4.1.3.6 [MUST] When the Verity Key is inserted, the user shall be prompted to enter the Verity Key passcode.
- 4.1.3.7 [MUST] The “clear” function shall be executed only if the Key validation is successful.
- 4.1.3.8 [MUST] When the clear function is executed:
 - 4.1.3.8.1 [MUST] “Clear ballots and counters” is logged in audit logs
 - 4.1.3.8.2 [MUST] Device public counter is set to zero
 - 4.1.3.8.3 [MUST] Device sheet counter is set to zero
 - 4.1.3.8.4 [MUST] All CVRs on vDrive are deleted
 - 4.1.3.8.5 [MUST] CVRs from this session on internal memory (CFast) are deleted
 - 4.1.3.8.6 [MUST] CVR data in database is deleted
 - 4.1.3.8.7 [MUST] Scanned ballot images on vDrive are deleted, if they exist
 - 4.1.3.8.8 [MUST] State of election is set back to “Configured” on vDrive, CFast, and in DB
- 4.1.3.9 [MUST] When the LAT ballots and counters are cleared, the polling place assignment must not be altered or deleted.
- 4.1.3.10 [MUST] When the LAT ballots and counters are cleared, the audit log entries must not be altered or deleted.



Verity Scan's modification to provide the capability to re-open polls after they have been closed has impact on both the **Verity Scan** device and **Verity Count**.

Pertinent Hart requirements are:

4.1.3.11 [MUST] When the Verity Scan tabulator is in a "polls closed" state, the tabulator shall allow users to "re-open" the polls to process additional ballots.

4.1.3.12 [MUST] When additional ballots are processed, the results of those ballots shall be combined with results of ballots previously processed on the same vDrive.

4.1.3.13 [MUST] The Scan tabulator shall require a reboot to re-open the polls.

4.1.3.14 [MUST] The Scan tabulator shall require the user to enter the Open Polls passcode to re-open the polls.

4.1.3.15 [MUST] When the polls are re-opened, the Scan tabulator shall retain all previous data associated with the configured election definition.

4.1.3.16 [MUST] When the polls are re-opened, the Scan tabulator shall retain all prior data associated with the tabulator's polling place assignment (configuration).

4.1.3.17 [MUST] When the polls are re-opened, the Scan tabulator shall retain all data associated with previous ballot scanning sessions, including:

- 4.1.3.17.1 [MUST] CVRs
- 4.1.3.17.2 [MUST] Audit log data
- 4.1.3.17.3 [MUST] Public counter

4.1.3.18 [MUST] When the polls have been re-opened, the Scan tabulator shall allow users to scan additional ballots.

4.1.3.19 [MUST] If the Scan tabulator is configured to allow users to print a Tally tape, the device shall generate a consolidated Tally tape that includes one combined total for each candidate/proposal on the ballot for all ballots processed in that precinct.

4.1.3.20 [MUST] This feature shall support a user's ability to repeat the cycle of scanning, closing, printing Tally reports, re-opening, scanning more ballots, and printing new Tally reports for as long as the original vDrive remains installed in the Verity Scan device.

4.1.3.20.1 [MUST] If a new vDrive is installed, the Scan tabulator shall follow the typical workflow to load a new election and clear counters.

4.1.3.21 [MUST] If Verity Scan is configured with the Relay option for remote transmission, the capability to re-open polls shall not limit a user's ability to remotely transmit results multiple times.



4.2 Hardware Configuration and Design

The **Hart Verity Voting 2.2** system, as declared in the application for certification submitted to the EAC, consists of:

- A **Verity Data/Build** workstation to create all election information and election media.
- **Verity Print** is a pre-voting ballot production device that is paired with COTS printer, to produce unmarked paper ballots.
- At the precinct level, **Verity Scan** optical scanners and **Verity Touch Writer** BMD configurations are employed.
- The central count location employs a high speed COTS scanner, in combination with a workstation that utilizes the **Verity Central** software, for tabulation of paper ballots.
- The consolidation, tally and reporting location employs a workstation with **Verity Count** software as well as a printer.

Note that these are the basic components of the system. **Verity Data/Build**, **Verity Central** and **Verity Count** can be run in standalone or networked configurations with additional client stations.

4.3 Test Suite Design

4.3.1 Software Functional Test Design and Data

SLI has prepared functional test modules using the operator/user procedures contained within **Hart InterCivic's** TDP. Functionality provided by the **Verity Voting 2.2** voting system is exercised in order to verify that each functional component performs as expected. Accept/reject criteria are based on requirements of the VVSG and the system specification documents provided within the TDP. As many of the individual functional components rely on preceding functionality within the system, SLI incorporates system level suites that employ modules that exercise the individual functional components of the system.

After analysis of the changes incorporated into the **Verity Voting 2.2** voting system, the following tests are implemented.

Verity Scan test suite – With many of the changes occurring within **Verity Scan**, the device will be given focused testing in order to verify that modifications implemented do not adversely affect operations, and that the device continues to meet all pertinent VVSG requirements.

Verity Relay test suite – The application does interact with the voting system in a significant way. As such, the application will be fully vetted, to verify compliance with the VVSG standards.



Verity Build test suite - With a few of the changes occurring within **Verity Scan**, the device will be given focused testing in order to verify that modifications implemented do not adversely affect operations, and that the device continues to meet all pertinent VVSG requirements.

Security, Telecommunications test – **Verity Scan** and **Verity Relay** will be the focus of this testing, as they are integral to the transfer of election day vote data. Testing will verify that these components meet all pertinent VVSG requirements.

Security, Access Control test – **Verity Scan** and **Verity Relay** will be the focus of this testing, as they are integral to the transfer of election day vote data. **Verity Scan** will be reviewed for access to the modem, while **Verity Relay** will be more comprehensively reviewed as a new component to the **Verity Voting** system. Testing will verify that these components meet all pertinent VVSG requirements.

Security, Software/Firmware test – **Verity Scan** and **Verity Relay** will be the focus of this testing, verifying that software/firmware is implemented as expected, as they are involved with the electronic transmission of information and are integral to the transfer of election day vote data. Testing will verify that these components meet all pertinent VVSG requirements.

Data Retention and Hardware Integrity test - **Verity Scan** and **Verity Relay** will be the focus of this testing, as they are integral to the transfer of election day vote data. Testing will verify that these components manage involved data as expected and meet all pertinent VVSG requirements.

Maintainability test – With the addition of a modem, in the **Verity Relay** option configuration, **Verity Scan** will be reviewed to verify no maintainability issues, and that all VVSG requirements continue to be met.

Error Recovery test – **Verity Count**, **Verity Scan** and **Verity Relay** will be the focus of this testing. Testing will verify that these components meet all pertinent VVSG requirements.

Audit test – **Verity Count**, **Verity Scan** and **Verity Relay** will be the focus of this testing. Testing will verify that these components meet all pertinent VVSG requirements.

General Election test – The full Verity Voting 2.2 voting system will be reviewed in order to verify continued integration of the voting system and that all components continue to work as expected.



Closed Primary Election test – The full Verity Voting 2.2 voting system will be reviewed in order to verify continued integration of the voting system and that all components continue to work as expected.

Open Primary Election test – The full Verity Voting 2.2 voting system will be reviewed in order to verify continued integration of the voting system and that all components continue to work as expected.

4.4 TDP Evaluation

SLI is completing an assessment of the deliveries of the Technical Data Package for **Verity Voting 2.2** against the **Verity Voting 2.0** TDP. The review will verify that documentation declared to be removed, is in fact removed. Documentation updated to remove references to removed functionality will be verified to have been appropriately updated. Any additional modification to previously reviewed documentation is being reviewed. Newly implemented documentation is subjected to full review. This review includes Functional Requirements, Specifications, End-user documentation, Procedures, System Overview, Configuration Management Plan, Quality Assurance Program, and manuals for each of the required hardware, software and firmware components of the **Hart Verity Voting 2.2** voting system.

4.4.1 Document Review

SLI conducts a PCA review of all vendor traced documents submitted for review in the delivery of the **Hart Verity Voting 2.2** TDP. These include:

- System configuration overview
- System functionality description
- System hardware specifications
- Software design and specifications
- System test and verification specifications
- System security specifications
- User/system operations procedures
- System maintenance procedures
- Personnel deployment and training requirements
- Configuration management plan
- Quality assurance program
- System change notes

Documents are verified for compliance to the 2005 VVSG, Volume 2, Sections 2.2 through 2.13 and Volume 2, Section 6.6. Unless noted otherwise, all requirements are successfully met within the pertinent areas of the TDP.



4.5 Source Code Review

4.5.1.1 Source Code Review

The certification campaign for the **Hart Verity Voting 2.2** voting system includes software and firmware that have been created/modified as proprietary to **Hart InterCivic**, as well as review of any commercial off the shelf products. SLI has conducted a source code review of all modified proprietary source code and modified COTS products submitted in the delivery of the voting system TDP for compliance to the VVSG version 2005, Volume 2, Section 6.6. The coding languages involved in the vendor's applications include:

- C
- C++
- C#

Source Code Review Tools utilized by SLI include

- Practiline Line Counter: a commercial application used to determine the counts of executable and comment lines;
- Module Finder: an SLI proprietary application used to parse module names from C/C++ and VB code and populate the identified module names into the review documents;
- ExamDiff Pro: a commercial application used to compare revised code to previously reviewed code; and

Any subsequent re-reviews of source code will be the result of fixes to discrepancies identified in the Functional Configuration Audit activities.

COTS Operating systems and software used in the voting system have been verified as authentic and unmodified in the **Verity Voting 2.2** test campaign.

4.6 QA & CM Process Review

The review processes employed are designed to verify that the manufacturer not only has written processes and procedures in both the Quality Assurance and Configuration Management arenas, but that those processes and procedures are actually implemented within the software development life cycle that is used to produce the **Hart Verity Voting 2.2** version that is submitted for certification.

The QA portion of the review focuses on the testing performed by **Hart InterCivic**. The scope of the testing performed is reviewed in order to verify that the manufacturer has verified all VVSG requirements are met. SLI reviews the test case design documents and data as provided by **Hart InterCivic**. In evaluating selected modules with respect to flow control parameters and data on both entry and exit, SLI assesses for discrepancies between the Software Specifications and the test case design. Additionally, interviews of key Quality Assurance staff may



be conducted to verify that the QA processes and procedures are known, understood and implemented by the appropriate personnel within the organization.

The CM portion of the review focuses on the organization's understanding and implementation of the declared configuration management processes, procedures and policies. Initial deliverables will be reviewed against all pertinent CM processes employed by **Hart InterCivic**. All subsequent deliveries will also be reviewed to determine that appropriate processes are employed. Additionally, interviews of pertinent staff, with regard to configuration management, may be conducted if determined to be necessary to verify that processes, procedures and policies are known, understood and implemented within the organization.

4.7 Trusted Build

The Trusted Build will be conducted prior to SLI's official testing and will be completed on site at SLI's facility. SLI will use its approved standard lab procedure that details the processes for controlling, managing, and conducting the Trusted Build. This process includes the following:

- Preparations for the Trusted Build – Obtaining and reviewing Hart InterCivic's procedure for constructing the build platform, verifying the target build platform, and acquiring and verifying the necessary materials, if rebuild of the existing environment is needed.
- Execution of the Trusted Build – SLI will perform the Trusted Build by using the step-by-step build procedure, as provided by **Hart InterCivic** to create a pristine build environment. SLI ascertains and records the following items throughout the build process:
 - Build environment images at various key points
 - Build environment and file hashes at various key points
 - Build environment hardware characteristics
 - Build results from code compilation and file hashes
 - Final software install files and file hashes
- Deliverables to Testing – Upon completion of the Trusted Build, certain items are sent to the SLI test group. The final result will be a media containing the following:
 - Final software install files
 - Hash values to validate install files
- Final Record Keeping and Archiving Procedures – At the conclusion of the Trusted Build process, SLI completes all final record keeping and archiving procedures at SLI's facility. This record keeping includes any unique identifiers,



results of the build with version numbers and dates, and descriptions of all hashes and images in the repository.

4.8 Standard VSTL Test Methods and Uncertainty of Test Data Measurement

This test campaign utilizes Standard VSTL test methods and election specific type test data only.

5 TEST DATA

Test data for the **Hart Verity Voting 2.2** voting system has been compiled such that all functionality declared will be tested to determine conformance to the standards.

5.1 Data Recording

SLI has evaluated the system functionality, as described by **Hart** technical documentation, as well as requirements as listed in the EAC 2005 VVSG 1.0, and made determinations as to expected results of all data inputs into the **Hart Verity Voting 2.2** voting system. This includes:

- Election type
- Precincts of all types
- Districts
- Offices
- Contests
- Candidates
- Parties
- Devices used
- Voting variations employed
- Issues/Referendums
- Votes cast for each candidate/issue/referendum
- Vote consolidation data from one device/level to the next

The data is contained in one master data record, including each input and each expected output. This data is incorporated into the appropriate test suite.



Testing information is recorded in the test suites, as well as in test notebooks, which are utilized according to SLI's standard lab procedure *SLP-VC-30 - Test Notebooks*.

5.2 Test Data Criteria

SLI has evaluated the system functionality as described by Hart technical documentation, as well as requirements as listed in the EAC 2005 VVSG 1.0, and made determinations as to expected output of all data inputs into the **Hart Verity Voting 2.2** voting system. A data matrix has been recorded into master data records, for each test suite, that couples data inputs to their expected output, as determined above. The system's execution shall be measured against the expected results.

6 TEST PROCEDURE AND CONDITIONS

This section describes the test conditions and procedures for execution of test suites. If a particular sequence is mandatory for the execution of suites, a rationale will be given. Additionally, this section is used to describe procedures for setting up equipment that will be utilized in the execution of the test suites.

6.1 Facility Requirements

Testing will be performed on site at SLI in Denver, Colorado.

Four secure labs are available with appropriate power supply and space to accommodate the various configurations defined within this test plan. Temperature/humidity gauges will be employed in order to determine the appropriate conditions exist during testing.

Unless otherwise specified herein, all remaining tests, including system level functional testing, shall be performed at standard ambient conditions:

- Temperature: 25°C ± 10°C (77°F ± 18°F)
- Relative Humidity: 20 to 90%
- Atmospheric Pressure: Local Site Pressure

All TDP and test documentation is stored on site at SLI's facility in a secure project directory on SLI's secure Voting server.



6.2 Test Setup

Configurations of **Verity Voting 2.2** will be deployed that conform to each specific test suite's needs. In all instances **Verity Voting 2.2** documentation will be followed in the setup of the configurations.

Successful completion of operational status checks will indicate that the system is ready for test execution.

6.3 Test Sequence

While there is no required sequence for performing voting system certification testing and audits, there are prerequisite tasks for some testing. Any needed prerequisites are contained within the suite for that test.

6.4 Test Operations Procedures

An inventory has been performed to verify the voting equipment received contains hardware and software elements as defined in the TDP prior to commencement of testing.

Throughout the testing effort, test suites and modules will be marked as follows:

- **Accept** – Test is accepted as successful.
- **Reject** – Test is rejected as unsuccessful.
- **NT** – Not Testable is used for test modules that cannot be completed. For example, if failure of one test modules failure precludes attempting subsequent test modules, the latter will be marked as NT.

Test results **Reject** and **NT** will include comments by the VTS explaining the reason for the result.

Issues encountered during review and testing will be documented on the Discrepancy Report and on the EAC's VRT. Test findings showing that an aspect of the voting system does not conform to the requirements of the identified test standard will be marked as Documentation Discrepancies, Source Code Review Discrepancies, Hardware Discrepancies, or Functional Discrepancies.

Issues that are encountered during testing or documentation review but are not addressed by the applicable standard will be added to the Discrepancy report and noted as Informational. The vendor has the option whether to address Informational issues. All responses provided by the vendor are noted in the Discrepancy Report attachment to the Certification Test Report.



7 Approval Signatures

SLI:

A handwritten signature in blue ink, appearing to read 'Traci Mapps', written over a light blue horizontal line.

Traci Mapps
Director of Operations, SLI Compliance
10/17/2016

End of Certification Test Plan
